Author’s response to reviewer 1

Legend:

- Reviewer comments in blue
- Author’s responses in black

General comments: Rosset et al. reported high-resolution sensor data to investigate the mechanisms driving DOC concentration at the outlet of a bog and a fen in the French Pyrenees. The data and results are interesting. However, the paper can be improved further by explaining how complete are the sensor data, and providing discussion on how water temperature is related with the input and output of organic carbon in the bog and the fen. Specific comments are below, which the authors may consider when revising the manuscript.

We thank the reviewer for this overall positive evaluation of our manuscript. Following the reviewer’s suggestions, we have improved the manuscript to include details on the data on which the analysis is based. The effect of temperature on DOC inputs and outputs have been clarified in the discussion section. The answers to the specific comments can be found below.

p. 4, line 10-24: What is the percent of data for which gap-filling models were used? Also, has there been any period of power outage? The merit of this paper is on the high-resolution ‘sensor’ data. Thus, the information is needed on the number (or the percentage) of data points that has been actually collected.

The gap filling represents between 5 and 80 % of data. Details have been included for each parameter in the manuscript (Section 3.1 P4 L14 to 26).

p. 5, line 8-: How accurate was the analysis? What was the recovery of the reference material?

The quantification limit was 1 mg. L^{-1}. Above this value, the analytical uncertainty was evaluated to ±0.1 mg.L^{-1}. Reference material included ION-915 ([DOC]= 1.37 ± 0.41mg C L^{-1}) and ION 96.4 ([DOC]= 4.64 ± 0.70 mg C L^{-1}) (Environment and Climate Change Canada, Canada). This was detailed P5 L 15 to 17

p. 5, line 12-: If the data with >20 FNU were ignored, what is the percentage of those “ignored” data points compared to the total?

Also, considering that [DOC] can be high with high flow, those data points are potentially important in interpreting the results. If included, could they change the conclusions?

The removed data related to high turbidity represent only 0,2% of the fDOM time series. In addition, the turbidity peaks occur before the fDOM peaks. Their removal from the timeserie does not affect our analysis. Some details have been added in the manuscript (P5 L21 to 24).

I think the graphs showing the relationship between the [DOC] and fDOM would be helpful. Can you add the graph as a supporting information?

Graphs showing the linear relationship between [DOC] and fDOM were added in Appendix A1

p. 5, line 16: number of observations 174 vs. 27. Why are these so different?

The different observation numbers are related to the different observation periods in the two sites. The survey started in 2015 in Bernadouze and in 2017 in Ech. Moreover, the number of flood event sampling (~20 samples each in average) differ between the two sites. Seven events could be sampled in Bernadouze, when only one was sampled in Ech. The number of observations at Ech was actually 28, it has been modified in the manuscript P5 L28

p. 5, line 27: what is the K in the equation 1? Please explain the terms in the equation.

K in the equation 1 was a constant. We replaced K by B in this second version of the manuscript to avoid confusion with K, commonly used in hydrology to described the hydraulic conductivity. Details have been added in the text to mention that B is constant P6 L9

p. 6, line 11: Have you used "DOC_max" for the analysis? If not, why didn't you include it for the analysis?

DOC_max was used in the analysis to calculate DOC_increase (DOC_increase= (DOC_max – DOC_initial)).

p. 7, line 3-: So, did log- or square root-transformation satisfy the assumption? Was non-parametric analysis unnecessary?

Prior to the analyses we checked the distribution of each variable using histograms and found substantial deviations from normality for some of them (mainly right-skewed distributions). Therefore, we transformed these variables using log-or square-root to approach normality (see Table 1 in the main text) considering that in linear modelling the point is not the reach strict normality of the data but to approximate normality in order to obtain satisfying distribution of the residuals i.e. Normality and Homoscedasticity of the error distribution (Venables & Ripley, 2002. Zuur et al. 2009). We then surveyed each best model using diagnostic plots in order to detect deviations from normality and homoscedasticity in the residuals and to identify outliers. No specific deviations and outlier were detected (See figures below) and we are therefore confident that our modelling approach and associated results are robust.

The use of non-parametric tests is always an option when normality assumption is grossly violated and when data-transformation cannot overcome deviation to normal distribution. However, non-parametric tests do not cope well with complex dataset and complex modelling. For instance, there is no non-parametric form of any regression. Regression means you are assuming that a particular parameterized model generated your data, and you try to find the parameters. Non-parametric tests are test that make no assumptions about the model that generated your data. Those two approaches are therefore incompatible.

In our study, we clearly favored parametric approaches in order propose hypothetical models explaining our two targeted variables i.e. DOC_increase and DOC_initial.

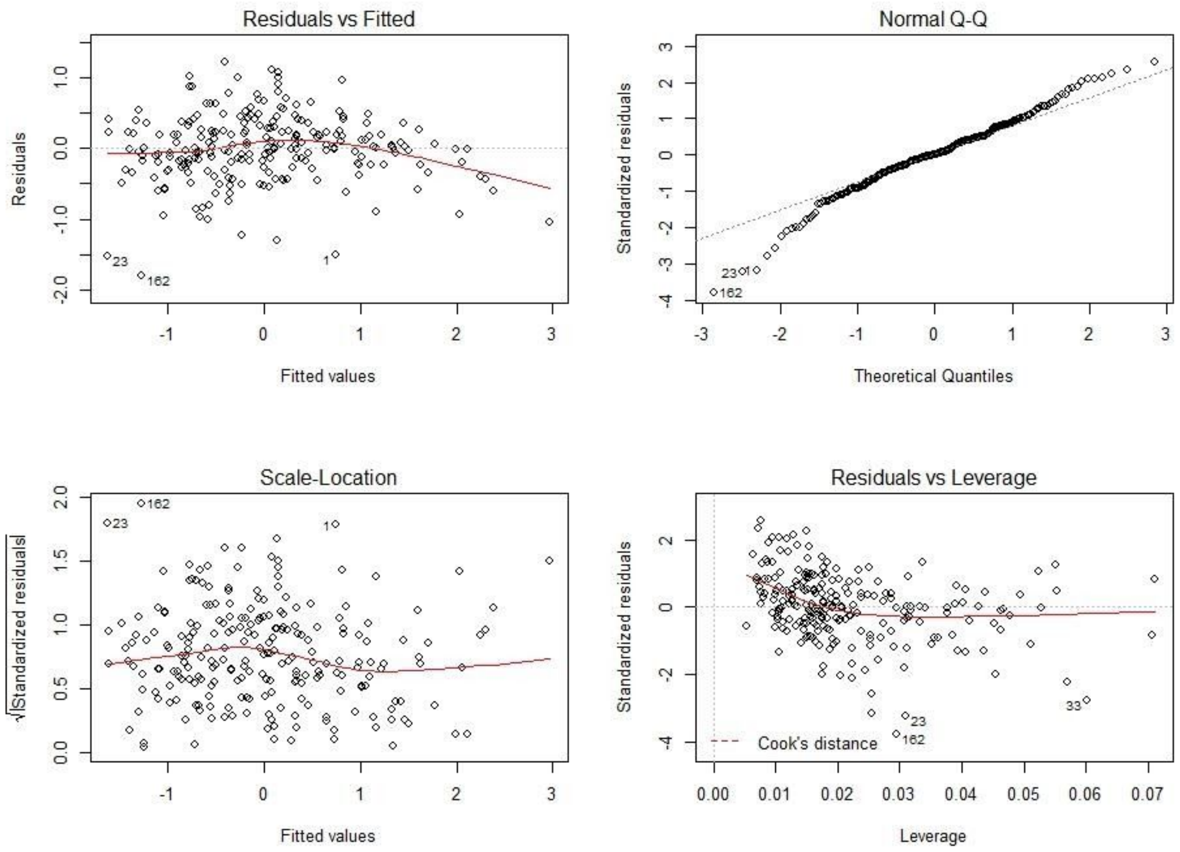

Figure review 1 Diagnostic plots of the DOC concentration increase in Bernadouze

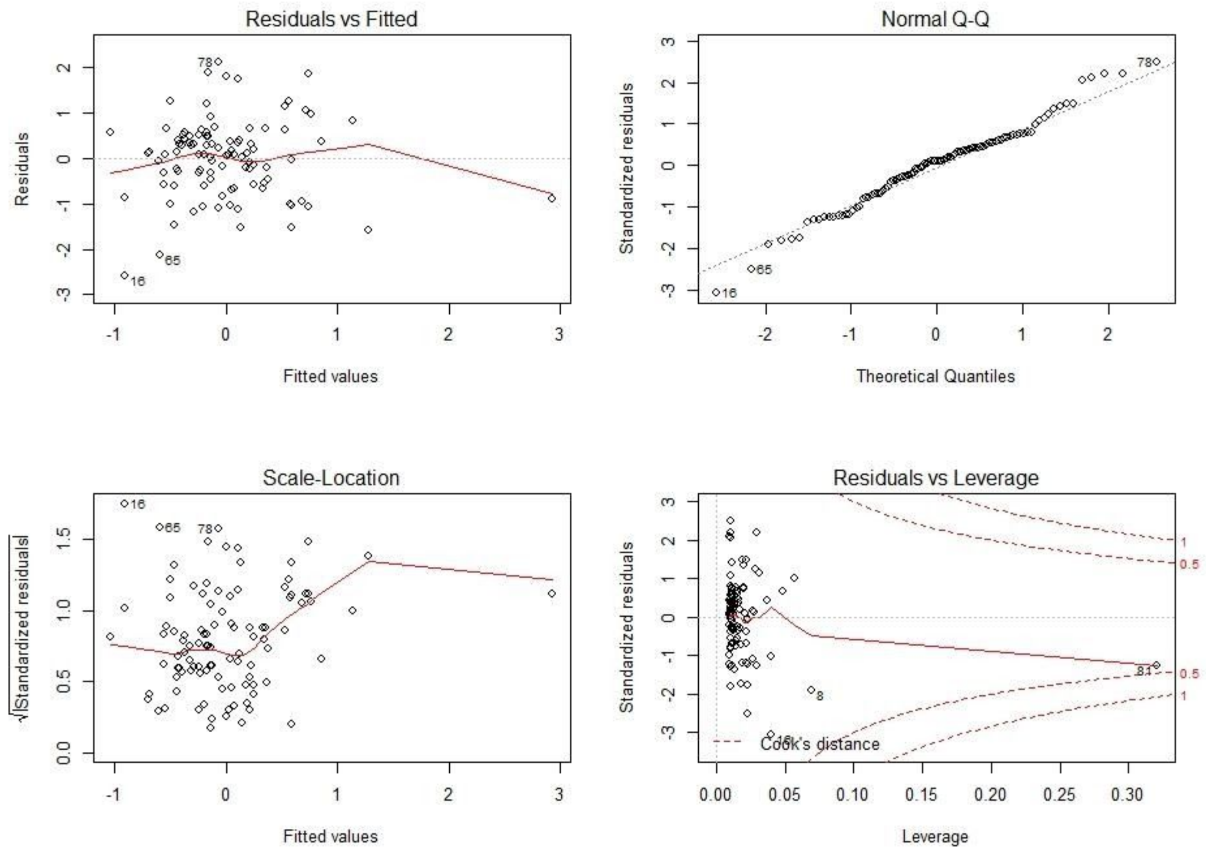

Figure review 2 Diagnostic plots of the DOC concentration increase in Ech

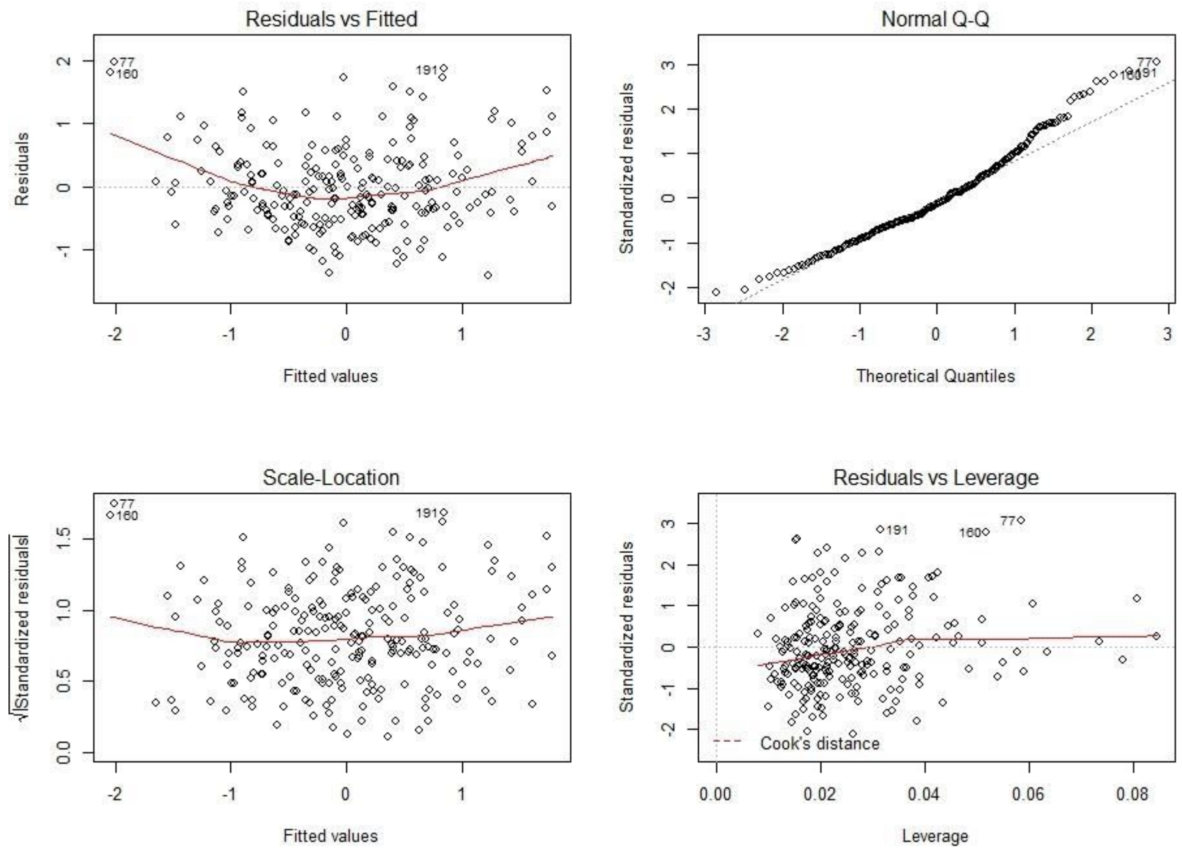

Figure review 3 Diagnostic plots of the DOC concentration initial in Bernadouze

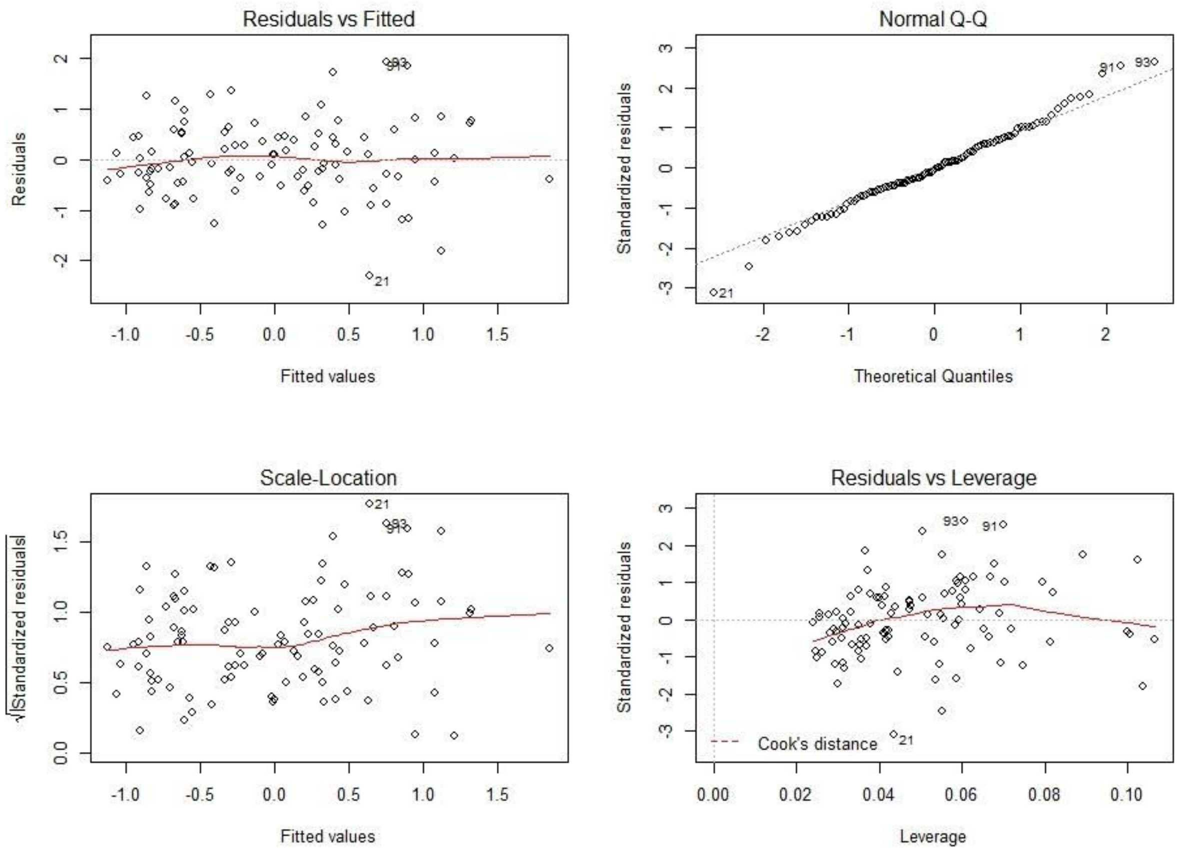

Figure review 4 Diagnostic plots of the DOC concentration initial in Ech

Fig. 1: Is the boundary of the watershed for the 'outlets' correct? Watershed boundary can be delineated for any point of a stream using DEM data. The watershed area for the red circles should be larger than the boundary of the fen or the bog (orange lines in Fig. 1). I wonder the DOC dynamics at the outlets could be significantly influenced by non-wetland areas considering that the stream lines are extended beyond the orange lines.

At both sites watershed boundaries have been delineated using DEM models, however only the peatland areas (3% of the watershed area in Bernadouze and 6% in Ech) were delineated on the figure 1 (orange lines). Peatlands are the main contributors of DOC at the outlets as reported in Rosset et al., 2019. This was explicitly written in the manuscript P4 L 6

Fig. 3: Is the purpose of this research on comparison between the fen and the bog? If so, which period should be used? The same overlapped period (May, 2017 to Jan 2019)? Or any period with available data? If you have chosen the second option (any period with available data) to maximize analysis power, why did you omit the period of Jan. 2015 to Sep. 2015 (Rosset et al., 2019, JGR-Bioigeosciences)?

The purpose of this research is not a direct comparison between a fen and a bog site. The purpose of this manuscript is to identify the drivers of the DOC concentration variability at peatland sites in general, so the period used for the analysis do not need to overlap. Moreover, the period between January and September 2015 was omitted in Bernadouze because almost 60% of the water table level sensors shot down during this period, preventing a good characterization of the mean water table level in the fen and consistent analysis.

Fig. 4: Interesting graphs. (a) When log (DOC initial) is~2.0, the DOC initial should be~100 mg/L. But, the maximum [DOC] in the Fig. 3d is~30 mg/L. Why are these this so different? (b) What are the meanings of the y-intercept? When water table increase is 0, the log (DOC increase) is about -1 (fen) and +1 (bog). Then, DOC increase should be 0.1 mg/L (fen) and 10 mg/L (bog) even without the water table increase.

This is a mistake in the notation. The Logarithm (log) in this figure refers to natural logarithm, or neperian logarithm (ln (e) =1) and not as logarithm used with a base 10 (log 10 (10)=1. This has been corrected in an updated version of the figure.

What kind of mechanism is working? Concentration of DOC shows the dynamic balance between the input and output of organic carbon. How water temperature is related with the input and output of organic carbon in the bog and the fen?

We agree that concentration of DOC shows the dynamic balance between the input and output of organic carbon; However in these mountainous peatlands we observed that DOC concentrations are really lower at the inlet than at the outlet, as mentioned by Rosset et al., (2019). Thus, the mechanisms which control DOC concentration at the outlet occurs mainly within these peatlands and we did not consider that input of organic carbon from the inlet was a valuable variable to investigate, as input water temperature. However, the role of water temperature was investigated both within the peatland in the piezometer well and at the outlet in the stream. We highlight significant influence of peat temperature on seasonal variation of DOC concentration. This is discussed in detail at section 5.2.

Fig. 5: The graphs include many information and are hard to digest. I recommend to leave essential information only and provide the rest as a supporting material. Or figure caption can include in-detail explanation on the symbols

The figure caption has been modified for clarity. In addition, the legend in the figure has been enlarged.

Cited references:

Rosset, T., Gandois, L., Le Roux, G., Teisserenc, R., Durantez Jimenez, P., Camboulive, T., & Binet, S. (2019). Peatland contribution to stream organic carbon exports from a montane watershed. Journal of Geophysical Research: Biogeosciences.

Venables and Ripley. 2002. Modern Applied Statistics with S. Springer, New York. 4th edition.

Zuur, A., Ieno, E. N., Walker, N., Saveliev, A. A., & Smith, G. M. (2009). Mixed effects models and extensions in ecology with R. Springer Science